Capacity building in bananas

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Australian Banana Growers Council Inc

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Summary

Australian Banana Growers' Council (ABGC) organised two study tours, one in 2013 and one in 2014, to give Australian banana growers an opportunity to see first-hand banana growing and marketing overseas. Mr Marc Jackson was engaged to develop an itinerary to address the specific aim of each tour.

The aim of the 2013 study was to provide innovative and youngish growers with the opportunity to see the various practices used across the supply chains in China and the Philippines, and to help them gain a greater of understanding how these impact on production in Australia.

China and the Philippines are some of the world's largest banana producing nations and are dealing with Panama disease Tropical Race 4. This disease is currently restricted to the Northern Territory in Australia. The study tour to China and the Philippines enabled Australian growers to experience banana production in those countries and to see the research being conducted into Panama Tropical Race 4 and the methods growers are using to deal with the disease.

The study tour also provided the opportunity to understand of how foreign markets operate and also provided brief exposure to export oriented commodities through attendance at Asia Fruit Logisitica.

The key learnings and recommendations from the 2013 study tour were around the themes of appreciating disease-free status in Australia, making changes to implement quarantine/biosecurity procedures, looking at costs of production and changes to fertiliser application methods and types.

The aim of the 2014 study was to provide innovative and youngish growers with the opportunity to see first-hand the various practices used across the supply chain in Ecuador, Costa Rica and Martinique, and to give them an opportunity to see production systems with a focus on quality which they may want to modify and implement on their own farms.

Banana production in Central America is known for high quality fruit for export as well as innovations which lead to minimal waste.

The key learnings and recommendations from the 2014 study tour focused on bunch protection, consideration of chemicals, sap management, varieties, the complexity of Australian cartons and potential collaborations.

To share their learnings from the tour with other growers, study tour participants have provided written notes and photos for use in 'Australian Bananas' magazine and this report and have spoken at or will speak at local banana growers association meetings. A list of recommendations from each tour has been collated.

Keywords

Banana, biosecurity, quality

Part 1: 2013 Study Tour - China & Philippines

1. Outcomes

The aim of the 2013 study was to provide growers with the opportunity to see the various practices used across the supply chains in China and the Philippines, and to help them gain a greater of understanding how these impact on production in Australia. A key area of the study tour was how the growers in China and the Philippines deal with diseases like Panama disease Tropical Race 4 (TR4), moko and black Sigatoka. These diseases are not present in the major growing areas of Australia.

5th September - Asia Fruit Logistica Exhibition, Hong Kong

Trade show for international fruit and vegetable business

- From discussions we could see that one of Australia's biggest problems in exporting produce the rest of the world is our cost of production. We are in a prime position to supply produce to all of Asia but we cannot compete with other countries with significantly lower cost of production. Despite this there was a high level of Australian representation on the world stage.
- The sophistication of transport, handling and marketing of fruit and vegetables was noted especially the innovations being made in the packing sector to preserve the quality of fresh produce and also to suit long distance shipping and increased life on shelves. Some growers gained a few ideas in the field of long life packaging for bananas and papaya.
- Given that Australian Bananas are marketing themselves as snack foods it was interesting to see which other commodities are being marketed as snacks foods (e.g. radishes)
- Lots of weird and wonderful varieties of fruit such as blue apples and grapes that taste exactly like cotton candy.

Snack radishes - it was interesting to see fruit and vegetable promoted as snack foods.

Snack pack blueberries.

6th September, Nanning, Guangxi Provence, China

Notes on banana production in China

- Banana supply timing in China by province:
- Hainan - April to July
- Guangxi - August to December
- Yunnan - December to April
- Guangdong - July to September
- Philippines - imported all year round
- Ecuador - only be imported when there is no banana on Chinese market, mainly goes into supermarket

In Guangxi province there are approximately 100,000 ha of bananas. These are all harvested in a 4 month period commencing in late August and going through to late December. This is due to frosts that the region experiences in January to March. The plantations are crop timed such that trees are small enough to survive the frosts and then grow and fruit matures during the Autumn, early Winter period.

Most fruit in the region is the Cavendish variety, Williams although we did view several other varieties during our bus trip to the farms including Ducasse, Senorita and Red Dacca.

Most farms in the region exist for 6-7 generations with the oldest plantations getting to around 8 generations. Due to crop timing demands de-suckering technique was very much a selection for sucker size and not position and as a result older paddocks have very little structure left for rows etc. Due to the lack of mechanisation farms are set up with single row, single sucker style and approximate density is 2000 trees to 1 ha. (approx. 800 trees to the acre).

Ripening of fruit from Guangxi is typically ripened using liquid ethrel - several spoons in the box on top then close it up. Ethrel in a "tea bag" is used by dropping one into a box and closing the box back up. Some of the large multinational companies are starting to do compressed gas ripening.

The government owns all land in China and gives small plots to families and individuals for their own economic means. What the larger farms have been able to do is lease these small plots from smaller farmers and pay these farmers for their land (10 year leases). The going rate for this lease is 2,200 USD to 2,700 USD per ha which is some of the lowest lease costs in all of China. There are no other viable means for large farms to be developed other than through this mechanism. Farms in the region have had 3-5 years of very good returns so there is some very well off farmers in this region.

JinSui Agricultural Company

Five areas of investment: 1) Banana growing, the main investment of the whole company, biggest grower of China, 2) Banana tissue culture, 3) Organic fertiliser production, 4) Industrial and edible alcohol production and 5) Production of banana powder (flour) – planned for the future.

The banana growing business consists of 2,066 hectares of bananas with 15 branches with an annual production of 108 thousand ton. There is also 360 ha of sugarcane. The company contract families to manage from planting to harvesting and packing. Every family contract 7000 plants, 1500 plants in 1 hectare.

Great attention is paid to how fruit are covered. Flower parts are removed, paper is inserted between the hands to protect them from damage, a tight fitting 'sock' is used to constrain fruit size and to curve the fruit, more padding and then a bunch cover.

Banana growing operations:

- Growers perceive the biggest threat is from cold and frost; banana can die from it within one year
- Fruit are bagged in a double bag to with a formation bag (cloth bag tightly tied) inside to keep the hands bent and shorter (at about week 4-8). The bagging may also prevent under peel chill by keeping fruit warmer. De-flowering is done before bagging and thick paper or foam is used between hands to stop dry scarring.
- De-sucking: killing suckers by spading; twice per year; 1st is not to kill, only cut down to make a bigger root system; 2nd is to select the best one, dig the unneeded ones out. How the suckers are selected depends on the demand market, if the market needs fruit sooner then larger suckers will be selected.
- De-leafing is ceased close to harvest, plants are left to die after harvest
- There is a prevalence of women harvesting, in some cases carrying 2 bunches between them. All packing is now carried out in the paddock in this region and we viewed packing sheds that are no longer in use. They have mobile pack houses, the quality control in the pack house was next to non-existent from what I could see, and there was no grading system as far as size and quality. Cold storage was not used nor were pallets.
- Panama TR4 was viewed in these region but is not devastating like some other areas of the country and there were very few quarantine practices in place. There was a complacency around the disease.

Kinana Head Office for lunch (Jin Sui Agricultural Company)

- Brief presentation from Mr Lu:
- Kinana Bananas has an endorsement from the Chinese Government Ministry of Agriculture to produce bananas in Guangxi. They received a $50M AUD grant/loan from the government to help the industry over the next 5 years
- Vertical integration within the Jin Sui company including tissue culture production and fertiliser manufacturing

Mobile packhouses are set up in the field and boxes stacked straight into the truck for transport.

Gutan Market

Small market where small holder farmers bring their bunches to this central point to be weighed and they are then paid on the weight of bunches before a team of packers pack and stack this fruit on to a truck using mobile packing facilities similar to what we saw in the paddocks.

Yingde Fertiliser Group factory

Organic fertiliser plant owned by the Jing Sui Agricultural Company producing 45,000 ton in 2012, and aiming to produce 100,000 ton yearly in the next 5 years. At this facility they mixed 'organic' fertiliser which is primarily made up of the by products of ethanol production and tapioca mixed with sugar cane ash, bagass and mill mud 65°C for 20-30 days automatically mixed. They do not use any chicken manure as they believe there are too many heavy metals in this product. This plant was very impressive and produced very high volumes of product for use on company owned farms and growers that they worked closely with.

Organic fertilisers played a large role in plant nutrition in China, this is a large automated composter.

7th September, Nanning, Guangxi Provence, China

Visit to the Lu Shui Jiang banana Farm (Mr Jiang)

Smaller farm of approx. 130 ha near Nanning. This farm was owned and managed by a grower who first brought bananas to the area. We saw a lot of plant crop during today and it was astounding to see how even this crop was. This grower is called a "speculative grower" in that he grows bananas independently and then trades his bananas through a wholesaler/exporter rather than being vertically integrated.

The fertigation and irrigation system was very high tech and automated. The fact that the most part/if not all of their fertilizer program was organic composting is something that we can all take home and learn from.

The were high levels of sophistication in the fertigation set-ups on larger farms in China.

Again observed in-field packing of fruit. Many of these field workers transfer to working within the packing crews when it comes time for harvest. Very little paddock work is done after bunch emergence, bagging and tying. This includes the leaving of trees in the paddock after bunches are cut and no deleafing or tidying up paddocks despite the prevalence of high incidence of black Sigatoka in some areas. We saw very little evidence of Panama disease but that could also be attributed to the high percentage of plant crops viewed. One of the mechanisms for getting chemical out in the paddock for spraying is to have a pipe which ran approximately 40m apart throughout the paddock with an outlet that came out every 10th row. Workers would carry long hoses out in the paddock and hook up to these outlets and spray the undertree canopy or bunch. It is an interesting idea and very efficient when the operations are being performed on foot, though not practical in Australia, not to mention the obvious environmental risks.

Guangrun Farm (Mr Wang "The Professor")

Field walk with a demonstration of bagging and then sit down discussion (through translators) with grower regarding fertiliser usage and how to address pH issues. On this farm the grower uses 20-30 kg organic fertiliser per plant per year. The soil in many of the farms we visited around Nanning had a very low pH (3.8-4.2). The grower though that the very low pH on his farm was having an effect on the expression of Panama

A pipeline pumped agrichemicals directly into the field and the field workers carried large hoses and taped into the pipeline in the paddock.

disease. The whole study tour group discussed with the grower how he could raise his pH using lime. It was great to see members of the group providing guidance on methods of raising soil pH through the irrigation system and was a two-way discussion instead of the study tour just taking away learnings.

9th September, Sanya, Hainan Provence, China

Gao Ming banana farm (Mr Ma)

- On the way to the farm we viewed huge areas of land that used to grow bananas that are no longer under production due to Panama disease Tropical Race 4 (TR4). We were told that the industry in Hainan province was at one time up to 100,000ha and supplied much of the fruit for Chinas population between April and July.
- At the Gao Ming banana farm Panama disease was prolific, Mr Ma is taking out his bananas and is going to plant papaya
- Due to Panama disease, in 5 years time there won't be bananas in Hainan province and China will have to import bananas most likely from the Philippines during the window Hainan currently fills
- We gained access to a paddock with visible symptoms of Panama TR4 and examined in more detail the symptoms of the disease including the internal structure of the trunk once the disease takes hold.

One of the highlights of the trip was the discussion on different methods of applying lime and raising pH between Chinese and Australian growers.

We had some good discussion amongst the group regarding quarantine measures and the impact that a disease like Panama TR4 could have if it became prevalent in the Queensland growing area. We also discussed some concerns regarding the communication on diseases including Panama TR4 and Race 1 within the NT and Qld growing areas and how important it was that open and transparent communication between the industry and key stakeholders (such as growers) regarding these issues.

- This region is susceptible to typhoons and we viewed some of the methods that local growers use to support banana trees, the most popular of these being bamboo posts that are pushed into the ground close to trees and banana plants are tied to these structures.

On Hainan Island Mr Ma allowed study tour participants to closely inspect and cut down his plants badly affected with Panama disease TR4. This was a useful exercise and promoted much discussion on biosecurity on-farm and in Australia.

Internal symptoms of Panama disease TR4 in a plant on Hainan Island.

Jian Feng Ling Banana Farm Wanzhong

This was the first farm we visited where there were some quarantine practices implemented. We were not allowed to walk into the paddocks and had to instead stay on the headlands. The grower was trialling different varieties for Panama TR4 tolerance. The plants were 3 months old and roughly 1.5m high, they were showing no sign of the Panama TR4 disease - normally the plant will start to show symptoms around the 3 month stage. There was a patch of non-tolerant bananas next to the panama tolerant ones that were the same age and size and they were already showing signs of the disease. The farmer expects at least 3 crops from this variety. The skin on the banana is thicker and fruit have a longer shelf life but the bunch formation is poor.

There was also trial of new varieties with crop rotation with pineapple and fertigation was using a specially designed organic fertilizer.

Jian Feng Ling Tissue Culture Laboratory

At this tissue culture facility they replicate planting material up to 10 times and verbally told us that they believe they can get up to 2000 plants from 1 piece of planting material. In Australia it is generally accepted that plants should not be replicated any more times than achieving 500 plants from an original source of planting material.

Unlike in Australia, only tissue culture is used and not bits and suckers. In Australia tissue culture is used primarily as a 'clean' planting material source, in China it seemed to be more used to scale-up production quickly and because the cost of labour is so cheap. Whilst tissue culture plants are clean when they come out of the laboratory, we observed potted plants on the ground where they could be exposed to pests and diseases and river sand was often used as media (non-sterile).

Clean tissue culture plants planted into a nursery where there are no quarantine measures.

11th September, Davao, Mindanao, the Philippines

Davao box factory

- 100% virgin material for export boxes - local boxes are recycled paper
- Interestingly, this company procured paper for box making from Australia, New Zealand and Canada but still the price of the boxes is less than half of Australian made boxes - a reflection of operational costs in the Philippines. Imported paper is tax free if the box is then exported.
- 90% of their productions is banana boxes
- Their quality of boxes is thicker and stronger than in Australia and boxes having bigger holes in them for ventilation purposes.

Macondray plastics (Macplus)

Plastic factory visit offered a good look at the range bags they produced, tailored for banana industry- an impressive result of collaboration between the industries. This company also bought back used plastic from banana farms and other users demonstrating a strong commitment to strong eco-friendly practices.

The plastics factory produced pesticide (chloropyriphos) impregnated bags and polypropylene twine as well as bags for packing bananas in. The bunch covers are made with different size holes depending on the season (small holes in bags in dry season and bigger holes in wet season). For the insecticide impregnated bunch covers the banana thrip is attracted to the smell of the emerging bunch flowers not mature bunches. Fumigation is immediate once the cover is installed and expose to UV light.

The company also has a waste plastic film recycling plant (visited on the afternoon of the 12th September) - encouraging a closed loop product. Using a percentage of recycled material does not compromise the final

product and is 60%-70% of costs in raw materials. The old materials are shredded, then washed and dried before being added to the mix of new plastics, can't use more than 20% recycled material in new products or else quality is compromised.

Recycling of plastic bunch covers in the Philippines.

Ansaldo Tissue Culture (TC) Laboratory and Nursery

- Fantastic example of a large scale TC nursery
- Incredibly cheap costs of production
- Interesting method of initiation and multiplication in the 'ketchup' bottles in an effort to contain contamination
- Pre-hardening step (kept banana cultures outside the building for 15 days before deflasking) to make them more used to the outside temperature. The banana nursery management was impressive making the plants ready for planting in 10 weeks of deflasking. Absolutely perfect conditions for growing out TC plantlets and amazed by the 45 day time from planting the TC in the pot to sale.

The Ansaldo Tissue culture laboratory and nursery was very impressive with fast growth of plants after potting-on. The ketch-up bottle for initiating cultures in was very interesting

Access to the nursery at Ansaldo was restricted and the whole nursery was netted.

12th September, Davao, Mindanao, the Philippines

RBFI Farm

Much greater focus on on-farm biosecurity practices in the Philippines compared to China. We had to pass through a wheel wash and boot wash before entering a farm, each block was surrounded by a 2m deep drain that humans and animals couldn't cross and we needed to go through boot baths before entering each block. There were also practices like quarantining moko affected stools and burning with rice husk was noticed. Sigatoka being a major disease, up to 45 sprays per crop is applied making it a major cost for banana production. We learnt that with the right management of the TR4 affected areas the disease can be contained. Example was given of one particular farmer that had identified 3 affected areas and had made a 3 acre exclusion zone around each area and had one person who was well educated on the disease to maintain and manage those areas. This grower even went so far as to install CCTV on these areas in order to make sure that no one unauthorised had entered the areas. The bigger farmers also had their farms fenced off with the only entrance monitored by a security guard who made that all vehicles and passengers were sterilized with dipping troughs.

Farm practices in the Philippines were more labour friendly compared to China. For example cable ways were established in the farms to reduce labour in moving heavy bunches. This practice also reduced bruising damage to banana.

In the packing shed:

- Alum was used in the troughs to prevent sap
- Different postharvest chemical regimes for different markets, for Japan no postharvest fungicides are allowed, just chlorine as a sanitiser. Imazaline is used for the Middle East Market (longer freight period).
- Different products for each different market; 20%-30% of fruit to Japan is in collapsible trays, clusters to Japan in 12kg cartons, for Middle East whole hands are exported in 13.5kg cartons and Class B singles are exported to the Middle East
- Potassium permanganate bags used in the boxes to absorb ethylene - before use they were getting 10% soft green now 0.5% soft green. Cost = 10c each. Don't need to take these bags out of the box before ripening.

Darbco IFS Farm

The biosecurity measures were similar to the RBFI Farm. However, unlike the RBFI Farm, this farm is a farming cooperative with 282 members over 300Ha. Each farmer has 1ha each and they look after the field operations for those plants, at harvest all bunches are harvested at the same time but the bunches are tagged to identify who they belong to, in the troughs the hands are separated by floating nets. The Cooperative supply to Unifrutti who undertakes the aerial spraying on these farms. The cooperative purchases all materials required for packing and deduct any material used from the farmers earnings.

The fruit are assigned to their destination at the packing shed and a system is used to indicate where the fruit is to go i.e. different colour pallet corner posts and strapping for different locations, this makes it easier when delivered to the dock. A quality assurance (QA) officer is employed by Unifrutti at the packing shed to under take QA at the time of packing.

Fruit are palleted for a specific destination at the packing shed. Different coloured side strips and strapping tape was used to indicate the type of product (e.g. hands, clusters) and the port of destination.

Unifrutti Loading dock

- Delivered hot in open trucks, dry vans or chilled in reefer containers and there was no more than 24 hours from harvesting to cold storage at the docks – any later the fruit is rejected. Fruit is held for 24 - 48 hrs at the most before loading onto the ships.
- All rooms are temperature controlled separately, stored and Shipped 13.5 °C. Pulp temp taken on loading and the temperature constantly monitored on the ship, a pulp test is taken at the port on arrival. The temperature is controlled on the ship (not centrally controlled from land).
- 4 corridors of cool rooms, 100 rooms at 3,000 boxes (60 pallets) capacity per room - 300,000 boxes capacity at the docks. Can load 1,700 – 2,000 boxes per hour with conventional ships, can load 5,000 boxes per hour with new side loading ships. The port can handle 200,000 cartons per vessel and 2 vessels per week - 400,000 cartons per week.

Shipping containers with bananas being loaded for export. The facility on the right hand side of the photo consists of cooled corridors with many cold rooms which the fruit is loaded into within 24 hours of being picked.

2. Results of Discussions – 2013 study tour

Panama TR4 was discussed often on the study tour, below are a summary of points from the participants, these points were taken into consideration when the recommendations in following sections were made.

General Notes on Panama TR4 in China

- The disease was present in some smaller farms in Guangxi but still very small isolated patches in the bigger farms
- There was no wheel or boot washes before entering any farms or facilities
- We saw farms with isolated cases of TR4 where there was bunting tape around the infected plants but nothing else stopping animals and water passing through the area and spreading the disease
- According to our local guide there is not a lot of awareness on TR4 with the farmers. They believe that it is a disease they have seen before and that maybe it will go away
- Perhaps the cold winters in Guangxi keep the disease under control more than in areas that experience tropical climate all year round
- Apparently the Central Governments' view on TR4 is that bananas are not a staple part of Chinese diet. If there is a shortage of bananas the population will not starve. Wheat, rice, meat and vegetables are what keep the population fed. When there is no land left without TR4 they will simply import bananas from overseas.

A plant affected by Panama disease TR4 in Nanning in China taped-off so that field workers stay away from the plant. Soil could still be moved by animal traffic or by localised flooding.

Panama TR4 in the Philippines

- They take the disease very seriously – everywhere we went they made us go through wheel washes and boot washes before we entered. But still apparently not many areas in the Davao area left without Panama TR4. The typhoon last year silted up the rivers which means the next time it floods the flooding will be more widespread further spreading panama TR4
- We saw on one farm an area that was fenced off containing a possible Moko infection. They were preparing to burn rice husk over the area to treat it
- Biosecurity seems to be purely up to the grower/merchant to maintain
- The bigger companies i.e. Chiquita, Dole, Del Monte know the seriousness of the disease and the importance of containing it
- One farm had an outbreak and has managed to contain it. Another farm next to that one had outbreaks and didn't contain them and they are spreading

Deep ditches in banana plantations in the Philippines, note the foot-baths to get from one section of the plantation to another. The aim is to prevent the introduction of Panama disease TR4 and moko into the plantation.

3. Dissemination of Information - 2013 study tour

Study tour participants provided a written report on their experiences which was used to develop a PowerPoint presentation for other growers and used extensively in the preparation of this report (often quoting verbatim). They also were asked six weeks after their return what practices they had started to implement in their own businesses, or what their biggest learning had been, these were used in the preparation of an article in 'Australian Bananas' magazine (Appendix 2). The learnings were around the themes of appreciating disease-free status in Australia, making changes to implement quarantine/biosecurity procedures, looking at costs of production and changes to fertiliser application methods and types.

Presentations were made at the following meetings:

Mareeba Banana Growers' Association, 9th October 2013. Study tour participants attending were James Howe, Weiwei Cui, Andrew Serra, Shannon Paton, Dr Puthiyaparambil Josekutty and Jay Anderson. Jay Anderson lead the discussion with significant input from all of the study tour participants present.

Cassowary Coast Banana Growers' Association, 10th October 2013. Study tour participants attending were Shannon Paton, Ben Franklin, Craig Althaus and Jay Anderson. Ben Franklin led the discussion on the China leg of the tour while Jay Anderson prepared and led the discussion on the Philippines leg of the tour with significant input from all of the study tour participants present.

Banana Agribusiness Managers (BAGMAN) meeting, South Johnstone, 10th October 2013. Jay Anderson presented at this meeting of banana industry consultants, growers do not attend these meetings but it was a good way of informing the wider banana industry.

Ecosciences Precinct, 1st November 2013. Jay Anderson presented a similar Powerpoint to what has been presented at the other meetings to banana researchers and Biosecurity Queensland staff.

The 'Mareeba Express' ran a story on the study tour in October 2014 and interviewed study tour participant James Howe as part of that article.

4. Itinerary - 2013 study tour

Date	Day	Activity
4-Sep-13	Wednesday	Travel to Hong Kong
5-Sep-13	Thursday	Attend Asia Fruit Logistica Travel to Nanning, Guangxi, China
6-Sep-13	Friday	Visit to: - Jin Sui Company banana plantations - Gutan Market Place - Organic fertiliser plan (Jin Sui Company)
7-Sep-13	Saturday	Visit smaller farms and new plantations, visit market centre, banana trading
8-Sep-13	Sunday	Travel to Sanya, Hainan, China
9-Sep-13	Monday	Visit to: - Gao Ming Company plantation - Wan Zhong Company - Tissue culture laboratory
10-Sep-13	Tuesday	Travel to Manila, the Philippines
11-Sep-13	Wednesday	Travel to Davao, Mindanao, the Philippines Hosted by Unifrutti, visits to: - Daficor Box Plant - Macondray Plastics - Ansaldo Nursery
12-Sep-13	Thursday	Hosted by Unifrutti, visits to: - RBFI Farms - DARBCO IFS Farm - Macondray Plastics Recycling - CHISI Wharf
13-Sep-13	Friday	Return travel to Australia

Map of China, the regions visited are noted by the red dots.

Map of the island of Mindanao, the Philippines where Davao is located.

5. Recommendations and implications for Australia Horticulture - 2013 study tour

Panama disease

- Education of banana growers: Pictures/posters of what the disease looks like (if we get it, early identification will be extremely important)
- Education of the general public: entry into Australia video, article on Landline and newspapers (Courier Mail, The Australian) about the trip and the current threat, use of social media to spread the quarantine message – protect the Aussie Banana on twitter/facebook
- Co-operation with other industries and NT, NSW and Queensland Governments to spread the message on interstate quarantine concerns.

On-farm practices

- Foot bathes and controlled entry is important as you never know who is going onto your farm
- The fact that the most part/if not all of their fertilizer program was organic composting is something that we can all take home and learn from.

Packaging

- Can we use carton bags which can wrap bananas in cartons better than carton liners? We can tie the top layer carton bags by making a tight node to reduce the transportation rubbing. Packers can just close the bag simply then stick their number stickers to hold the two sides together.
- Fruity gift boxes – following on from the 8kg boxes seen at Asia Fruit Logistica

6. Acknowledgements - 2013 study tour

The tour group acknowledges the work of Mr Marc Jackson in organising a fantastic itinerary. Mr Simon Zhang is thanked for an excellent tour of the Chinese banana growing areas and the Jin Sui Company is thanked for its hospitality. Mr John Perrine, Unifrutti is thanked for the excellent Philippines itinerary and the group is also most appreciative of the time taken by Rey Valle, Unifrutti to host the group. Ms Weiwei Cui is thanked for her translation skills.

Welcome banner at the loading dock from Unifrutti

7. Participant List - 2013 study tour

Name	Location	Background
Mr Craig Althaus	Tully	Tissue culture lab and nursery
Dr Jay Anderson	Brisbane	Tour organiser & R&D Manager
Mr Darryl Apap	Mission Beach	Banana farming/ packing
Ms Weiwei Cui	Mareeba	Banana farming/ packing
Mr Benjamin Franklin	Tully	Banana farming/ packing
Mr James Howe	Mareeba	Banana farming/ packing
Mr Paul Inderbitzen*	Lakeland	Banana farming/ packing
Mr Marc Jackson	Cairns	Tour leader
Dr Puthiyaparambil Josekutty (Jose)	Mareeba	Tissue culture lab and nursery
Mr Stephen Mackay	Tully	Banana farming/ packing
Mr Aiden Mackay	Tully	Banana farming/ packing
Mr Shannon Paton	East Palmerston	Banana farming/ packing
Mr Andrew Serra	Atherton	Banana farming/ packing

* Paul Inderbitzen participated in the China section of the study tour as part of his Global Focus Program for his Nuffield Scholarship.

Study tour participants with 'The Professor' in Nanning, China.

Part Two: 2014 Study Tour - Central America

1. Objectives

The 2014 Banana study tour to Central America was designed to inform growers mainly about systems for good fruit quality. All participants were asked in advance what else they would like to investigate. These included integrated pest management, nutrition, black sigatoka management, packaging, alternative product categories and cost saving techniques, practices and devices.

- The Study Tour travelled from Australia to Ecuador, then visited Costa Rica, and finally Martinique in the French West Indies.
- Ecuador is the largest exporter of bananas in the world, followed by Philippines and then Costa Rica. Martinique is a banana producer in a developed nation.

2. Itinerary - 2014 study tour

- Details of farms, ports, research organisation and other banana entities in the three countires visited are in the table over page.
- There was considerable amount of flying time involved, 14 flights for the growers from North Queensland. As an example, it was not possible to fly direct from Costa Rico to Martinique (from the western to eastern Caribbean), instead the Study Tour needed to fly (all day) via Panama and Dominican Republic.
- The following map shows Central America, including all three countries visited, as well as the Panama Canal, through which banana ships from Ecuador are required to travel en route to Europe and the east coast of the United States of America.
- The Australian group had all agreed to the strict biosecurity measure in advance, as noted in Appendix 1. This included new blue shoe covers worn on each farm visited.

The map shows the location of all three countries visited

Banana Study Tour to Central America - July 2014							
	Date	**Flight**	**Depart**	**Arrive**	**Depart**	**Arrive**	**Duration**
Saturday	12-Jul-14	QF 799	Cairns	Brisbane	5:30	7:35	2h 5m
		QF 123	Brisbane	Auckland, NZ	9:40	14:50	3h 10m
		QF321	Auckland, NZ	Santiago, Chile	16:15	11:35	11h 20m
		LA 1446	Santiago, Chile	Quito, Ecuador	16:30	21:05	
		LA 1446	Santiago, Chile	Guayaquil, Ecuador	22:05	23:05	7h 35m
Sunday	13-Jul-14	Familiarisation tour - Guayaquil.					
Monday	14-Jul-14	Visit to several farms in Oro Province					
		Tour Banana ship loading at Puerto Bolivar, Machala					
Tuesday	15-Jul-14	Oro banana farms, including plant crop, near Puerto Inca.					
		Dinner meeting with Firesky (Banana grower, exporter, chemical manufacturer, i.e. Bioteccdor)					
Wednesday	16-Jul-14	Meeting with Eduardo Garcia, Executive Director, Ecuadorian Banana Exporters Association					
		CM 272	Guayaquil, Ecuador	Panama City, Panama	14:59	17:06	2h 07m
		CM 391	Panama City, Panama	San Jose, Costa Rica	18:25	18:50	1h 25m
Thursday	17-Jul-14	Post-breakfast presentation by Alasdair Macleod, Managing Director, Fyffes Bananas International					
		Tour Earth University's commercial banana farm and discussion with its Development Office					
		Visit various researchers at two campuses of Corbana Resarch Institute					
Friday	18-Jul-14	Visit to Guaria Farm, Frobana Farm and Bananera Siquirres Farm					
		Visit Maersk container terminal, Limon					
Saturday	19-Jul-14	CM 392	San Jose, Costa Rica	Panama City, Panama	8:31	10:49	1h 18m
Saturday	19-Jul-14	CM 128	Panama City, Panama	Santo Domingo	11:54	15:29	2h 35m
Saturday	19-Jul-14	AF 627	Santo Domingo	Fort De France, Martinque	18:50	20:30	1h 40m
Sunday	20-Jul-14	Rest day, Martinique					
Monday	21-Jul-14	Visit Anne Marie''s ripening rooms (Muma Fruits)					
		Visit Bertrand Aubrey's Chalvet farm and Frederick De Reynal's Farm, Basse Point					
Tuesday	22-Jul-14	Presentation at Bananamart (the banana industry association)					
		Visit smaller farms with Laurent Gervais from IT2: George Mamont's and Danielle Nouvet's					
		Visit to Antilles Vitro Plants nursery and presentation by Milagro on crop data analyses					
Wednesday	23-Jul-14	Ban Hackaert farm. Borer control on-farm demonstration by SCIC Environmental, Basse Point. Visit Habitation Clement					
Thursday	24-Jul-14	AA7294	Fort De France, Martinque	San Juan, Puerto Rico	7:25	9:25	2h
Thursday	24-Jul-14	AA1393	San Juan, Puerto Rico	Dallas, USA	11:55	15:45	4h 50m
Thursday	24-Jul-14	QF8	Dallas, USA	Brisbane	21:55	5:00	16h 5m
Saturday	26-Jul-14	QF798	Brisbane	Cairns	7:00	9:25	2h 25m

3. Outcomes - 2014 study tour

The following are the key points from the various farms and research institutes visited, by country.

Ecuador: 1° South latitude

Ecuadorian Banana Industry

The following information was mostly provided by the Ecuadorian Banana Exporters Association.

- Bananas are by far the biggest economic contributor, apart from oil, in the economy.
- Ecuador has 250,000 hectares (600,000ac) of banana plantations and annually produces around 6.8 million tonnes of bananas. This compares with 0.37mt off 11,000ha in Australia (2013/14).
- There are 8000 growers, who grow under Government license and produce on average 1,500, 18kg cartons/ha.
- A total of 375m cartons were produced in 2013. Exports totalled 260m (18 Kg[1]) cartons in 2013 and the 2014 forecast was for 280m.
- Most growers have very small acreage and a minority are very large producers and exporters.
- The official Government price to growers is US $6/carton which excludes freight and carton. This is designed to allow a 30% profit for grower (US$2) over their cost of production!
- A licence is required to grow bananas. Current banana farms are worth US$15,000 – 20,000/ ha

Exports

- 70% of Ecuadorian bananas are sent in containers and 30% stacked in hull of ship
- Ecuador exports 5m cartons per week.
- The main markets are European countries and Russia, as shown below.

Exports from Ecuador for first 6 months of 2014 (m cartons*)

North Europe	Russia	USA	Middle East	Eastern Europe	South America	Southern Europe	Asia	Oceania	Africa	Total
37	35	23	13	14	11	11	4	1	2	151
24%	23%	16%	9%	9%	7%	7%	3%	1%	1%	100%

*These are preliminary figures and in 18kg cartons

- Other Central (or middle) American countries are also large exporters, but not as large.

Average weekly exports for first 6 months of 2014 (m cartons)**

Ecuador	Costa Rica	Colombia	Guatemala	Total
5.8	2.2	1.6	1.2	10.8

**These are preliminary figures

1. All three countries produce 18 Kg cartons. Where this report discusses cartons, they are 18 Kg ones.

- Ecuador shipped 1.5m (18 Kg) cartons to New Zealand in 2013. The monthly average shipping to NZ (Auckland) was more than 40,000 cartons per month. Exports to NZ for the first 6 months of 2014 were 1.08 m cartons. Clearly capable of supplying the Australian market if they were to meet quarantine requirements!
- Sales to Europe while we were there (July) were maintaining a slow summer tempo, while the holidays were in full swing across the continent (school holiday impacts demand in Australia similarly).

Bagging in Ecuador

Oro Banana farms, near Machala

- Farms of 3000 ha were owned by Servio Segana. We also saw his 3 crop dusters and airstrip. He also owns plastic recycling business for bags and strings.
- Climate appears to be a steady 22-30 degrees with little wind. It was evident that banana leaves were intact and not shredded.
- Drainage is very important: Primary drains of about 2m deep and up to 4m wide were fed by secondary drains of 1m x 1m.
- Overhead cable system are used to transport bunches to shed. Pads are used to hump bunches to the cable. No machinery in the plantation.
- 85 workers /130 ha farm, i.e. 1 worker/0.6 ha
- Valery variety was prevalent.
- Stalks cut to about one metre were returned to the plantation.

De-suckering

- The sucker was selected on position and effect on mother plant's bunch, rather than on the vitality of the new follower, .i.e. the best sucker that won't interfere with bunch.
- One man de-suckers 47 ha every 6 weeks
- One sucker per stool. The sucker is tied to mother with strip of leaf.
- Fertilised every 45 days, 8 applications a year, 1 tuna can (107grams) around the stool.
- No nematicides used.

Pruning and Bagging:

- Fruit was very clean, lot of emphasis placed on the bunch bagging operation.
- They removed 4 hands in summer and 5 hands in winter to leave about 5 to 8 hands of Extra Large fruit, 21 - 30cm. Also broke off 2 wing bananas on each side of each hand.
- Harvest measuring the bottom hand girth at 31mm

- Used 4 Lorsban strips on each bunch
- Used plastic slip sheets between fingers and hands
- They removed the shade leaf, and followers were held to the side
- One man bags 12 ha and up to 5 visits each bunch

Black Sigatoka

- Black Sigatoka was noticeable throughout the plantations, but surprisingly did not seem to be getting out of hand as bunches were harvested with good leaf
- 24 aerial sprays each year: Only 24 because cool, drizzly weather keeps disease dormant for several months.
- Plant crop was the Israeli variety, GALL
- The variety looked impressive in the field, with optimal plant height and nice bunches

GALL plant crop, Ecuador

Packing Shed

- Condition of bunches entering packing sheds is very good leading to minimal waste.
- Speed and agility of workers was impressive. All male workers except for shed where women did the deflowering and sorting and clustering
- Sprayed bunches in shed with plant oil extract for mealy bugs
- No power used in packing sheds. Water pushes fruit, then manual rollers.
- Red tape was placed across troughs to ensure de-handed bananas are not hitting bananas in trough
- Used Alum Sulphate for crown end rot – all fruit treated
- While mostly 18kg cartons, there was some small packs of 24 premium pieces for military, hospitals and coffee shops etc.
- Foam spacers to set the cluster location while packing the bottom two rows in the carton

An Ecuadorian packing shed

- Workers are paid wages up to the de-handers, after that they are on contract
- Wages: $US85/40 hour week ($Au 2.25 /hr)
- Extra staff in shed (compared to NQ) of deflowering, washing and stickering.

Banana shipping at Puerto Bolivar

- The banana ships (which travel back to Ecuador empty) are both containerized and not.
- For loose stacked cartons in the open hold, the cartons were taken to port in old, small trucks, cartons were not pre-cooled before loading into ship and were sitting in an open shed ready to be loaded.
- 270,000 boxes hand-stacked loose into the ship we looked over. It was to take 5 days to load the ship, but less if more fruit was available, i.e. 4 levels hand-stacked x 14 cartons high, no pallets

Ship loading with loose cartons, Puerto Bolivar

Biotecdor products

- Met with Firesky (banana exporter) owner Lenin Contreras, son Jose and his management team. They send fruit in CA containers, and recently started sending to China. They also make cartons, do transport and marketing.
- They also run Biotecdor, which makes organic products and chemicals. Two of which the Australians were subsequently provided small volumes of samples to trial:

  Biolatex® - a postharvest Latex (Sap) remover, i.e. removes fresh latex and other residues from the skin of fruits such as bananas during the postharvest washing process. The actives are anionic surfactants 150g/L.

  Cochibiol® - an organic pesticide in the form of an emulsifiable concentrate. It dissolves the powdery outer layer of the insect, blocking its spiracles and asphyxiating it instantly. Kills mealybugs, whiteflies, scales, aphids and mites in different crops. The active is palm oil 800g/L.

Costa Rica: 10° north

Global Situation

- The demands from global supermarkets on environmental and social issues are increasing. Similar standards are being, or will be sought by Australian supermarkets.
- 10 different standards (including ethical, social and environmental) per grower. Supermarkets conduct random audits on growers.
- Costa Rican Government's "Forest Alliance" means can not use the herbicide Gramoxone.
- Retailers pay Fyffes after bananas sold at checkout (30 days after getting fruit). So for Costa Rica, where fruit spends 2-3 weeks in transit and then 1 week to ripen, it could be 30 days before bananas reach supermarket shelves and Fyffes are paid 30 days after that. Growers are paid once the fruit is on the ship.
- Travel times from Ecuador are longer due to the need to go through the Panama Canal. Retailers also insist on supplying exact volumes in contracts and just in time.
- Freight was $US 3-4 per carton to cross the Atlantic, from Limon on eastern side of Costa Roca, i.e. without needing to go via Panama Canal.
- Panama Canal costs 50cents each way or $US 1/ carton. The Canal is being widened to accommodate larger ships and which should reduce freight costs, e.g. for Ecuador exports
- Fyffes are to merge with Chiquita in January 2015, creating a very large banana and pineapple business.
- The above global information was mostly provided by Alisdair Macleod, MD of Fyffes Bananas International, when he addressed the Australian group in San Jose.

Costa Rican Bananas

- Costa Rica is the third biggest exporter of bananas in the world, exporting more than 100m cartons per year. Main exports are to the US and EU. Bananas are its largest source of foreign currency from agriculture.
- 98% of banana production is in the Carribean part of Costa Rica and the rest on the South Pacific side.
- The banana industry in Costa Rica employs 7% of the economically active population. Workers are protected by warranties under its Labour Code and its social security regime.

- Government dictated US$16 per 8 hour day for workers ($US2/hr)
- Most plantations have some form of social-environmental certification, and as a result of focus on this, was the first country to get GLOBALGAP certification.
- Corbana was set up by law to govern national banana industry with the objective of warranting the welfare of banana growers. Its functions are ruling production, providing credit, technical assistance, biological control, and conducting research, marketing and promotions.

Corbana Research Institute

- Black sigatoka: Corbana advised that across Costa Rica it costs $2000/ha to control.
- A main focus of Corbana research is to reduce synthetic fungicide applied by 50% in 10 years. They are 6 years into that 10.
- Borers[2] : Corbana are working on using a fungus for biological control of banana weevil borer, which is to be released in 2015 using 4-5 traps/ ha and costing US$1.50 /trap.
- Borer research using bacteria instead of fungus as a biological control, but some years off.
- Growers use 2-3 nematicides per/ year
- Costa Rican growers use limited fallow, only some banana rotations with pineapples

Earth University, Guapilies

- Presentation by Ms Fabiola Arrieta, Development Office Department, discussed academic program and educational model.
- The university has 3600 ha of which 2000ha is rainforest and 340 ha is a commercial banana farm. The rainforest makes the farm carbon neutral.
- Non-profit, private university, specialising in a 4 year Agricultural Science agronomy degree. Has 400 students, from 30 countries.
- There are donation opportunities to develop future researchers in developing countries.
- They are also interested in placement of students who have finished 3rd year at Earth in Australia for short term study periods (15weeks).
- No other tertiary institution in the world has on-campus access to a commercial banana plantation.
- Shown campus by Dr Luis Pocasangre including banana plantations, packing facilities and ripening centre. Farm aimed at reducing pesticides and sustainability.
- The 340 ha farm is divided into 5 blocks to get away from the monoculture formula. Claim to be very important in breaking down diseases.
- Some of their paddocks are 15 kilometres away, groups of 90-120 bunches travel by rail car on cable ways taking up to 2.5hrs one way. These cable cars are motorised, unlike elsewhere in Central America.
- Did not use slips between hands at bagging but put the 'diapers' in between inner and whorl of hands just before harvest for transport to the shed.
- Cutters use a 'jig' to hump bunches without any transfer of weight to shoulder.
- Black Sigatoka: Advised that it is impossible to grow bananas without fungicide.
- Earth Uni is in a high rainfall area of 4m per year, so high Black Sigatoka pressures. Some commercial growers apply twice a week, but Earth farm only applies 1 fungicide per week, i.e..49 to 50/ year or 15 sprays less than most commercial farms

2. In Central America, Banana Weevil Borers *(Cosmopolites sordidus)* were referred to us simply weevils. They are the same insect as that in Australian plantations.

- Earth Uni farm uses garlic and onion impregnated bunch cover bags.
- The farm uses compost 3 times a year and does its own on-farm ripening. This facility is used to ripen lower quality fruit for the domestic market.

Large Farms

- Like Ecuador, the sheds in Costa Rica are not for sorting out rubbish. Fruit coming into it has been looked after very well in the plantation. Less waste might pay for their extra bunch protection.
- Quality was the best of the trip here.
- Bananas grown on heavy soils with good natural rainfall.
- Seem to have some good environmental practices. Waterways are covered in vegetation to protect water quality. Soils looked very healthy with good biodiversity.
- Many farms seem to be using chlorothalinil program with good results.
- Visited a farm that used 74 sprays for black Sigatoka per year. Mainly preventatives and not systemics.
- A worker visits each tree 4 times in growing cycle
- Bunches are protected in a number of ways, eg foam between hands was used.
- Also protected by use of the humping jig.
- Bunch inspection upon arrival at shed, with results used to reward/penalise the harvesting crew
- Packing sheds ran well.

Typical Large Farm, Costa Rica

A humping jig, Costa Rica

- Post-harvest treatments for crown end rot were used by all facilities visited and minimal protection to workers applying these treatments was evident. The packing staff tended not to wear any form of personal protective equipment apart from gloves and apron. This provides more efficiency than what is required in Australia, where the biggest problem with traditional crown end rot treatments is the perceived issue of worker safety.

Small Farms

- We visited a small farm - Guaria farm, near Limon. It was packing pisangs (monkey bananas) for export to Tesco in London in 6Kg boxes in an old and small "shed". Plantation was in relatively poor condition, eg black Sigatoka, but was producing several varieties.

Packing shed, Siguerres, Costa Rica

- Even though this shed was primitive and did not appear to have a QA program, it had a large notice board displaying procedures and systems including workplace health and safety and safe food information. Evidence that their international customers are requiring standards to be met even in very small facilities. Nonetheless, questionable practices around food safety and general hygiene.

Packing Pisangs for Tesco in UK.

Maersk container terminal, Limon

- Starcare, membrane technology is used to monitor and control atmosphere in containers from central location. Even though the technology is in place in this large facility, it shows just how many checks and processes have to be in place to have successful transport of bananas for extended journeys.
- This technology is being used to transport bananas anywhere in the world, while controlling quality remotely. Fyffes is exporting all over the world with up to 60 days travel time to China.

Martinique: 14° north

A Banana Province

- Martinique is of 1,128 square kilometres and a province (or overseas region) of France, who governs it. Most bananas from it and Guadeloupe (together, the French West Indies) are shipped to France.
- Martinique exports little else and imports most goods.
- In 2013, 160,000 tonnes of bananas were produced. However, that year more than 40,000 tonne were lost to Tropical Storm Chantal.
- Martinique projected production in 2014 off 7300ha and 394 farms is 210,000 tonne (Australia for 2013/14 was 372,000 t off 13,000 ha). 85% of its production is by 25% of farms.
- That 7300ha equals 30% of surface area of Martinique.
- In addition (like Ecuador and Costa Rica) plantains are grown for local consumption.
- There are 3500 employed in the banana industry. Workers are paid 100 euros for a 7 hour day. 1 Euro = $Aus 1.40
- The Government provides a subsidy on a set minimum price, so that if returns are lower the government tops it up. Details were sketchy about how this works, but one small farmer noted growers get 9 Euros per 18 Kg carton, of which 90% was subsidy.
- All plastic is burnt, but only for 6 months in Martinique. The other 6 months it is transported to France for burning.
- The French Government banned all aerial applications from March 2014.

Black Sigatoka

- Black Sigatoka was first detected in September 2010. Impact on 2012 yield was a loss of 24,000 tonnes.
- Fungicides are required to control black Sigatoka and they now seem to manage this well.
- As aerial applications are forbidden, the leading growers spray for Black sigatoka using a quad bike every 4 weeks for 10 months (and up to 8 weeks in 2 months of dry season).
- See fungicide mister rig on a quad bike, where the trailer was the fungicide tank.

De Reynal's Fungicide Mister, Martinique

Early hand removal

Borer Control

- SCIC Environmental provided a demonstration on pheromone trapping in a banana farm and advised on the Banana Weevil Borer service offer
- The borers were controlled without chemicals using pheromone lure traps. The pheromone is Cosmoplus.
- In an average farm infestation, need 2 traps per acre. It is labour intensive to insert traps and to count and kill borers (e.g. they are burnt in a bag).[3]

Other chemicals not used

- *Regent* (Fipronil, to control banana rust thrips) is prohibited by French Government.
- No nematicides are used and most farms also do not apply any insecticides.
- One large farmer had an evaporator for chemicals washed from the packing shed. Concentrated solids were sent to France for disposal.
- All farms visited, including very small ones had good ground cover and used organic inputs (banana waste) on trees.

Bertrand Aubrey Farms

- Bertrand Aubrey oversees 7 farms with 60 ha of bananas each. He noted the size of each is optimum for management, e.g. each farm manager to know his employees well.
- On each 60ha farm they have 40 workers.
- He farms with no insecticides or nematicides.
- Plants 1650 trees/ha, which is slightly more than the average NQ banana farm.
- He makes his own mulch from banana waste and bagasse which is applied on the farm along with liquid chicken manure, in addition to his 11 to 12 applications of chemical fertilisers. He used to fertigate, but not any more: Now believes a better result achieved by broadcasting fertiliser once a month.
- Rotation is 66 months of banana followed by two years of Brachiaria (signal grass), then plants tissue culture.
- Farmer doesn't like leaves too green, believes when they are leaves are soft are susceptible to disease, also less green leaf promotes better quality fruit.
- Removes top hands of each bunch as early as possible, as well as lower hand, to leave around eight hands per bunch, which is very square in shape with all finger length similar. This reduces point scarring if done early. Doesn't lose much if anything in yield.
- Produces smaller bunches with much care.

3. Post-study tour contact has continued with SCIC Environmental and entomologists researching Borers in Australia.

- Fruit is very full when harvested.
- Bunches are bagged 1.5 times per week and is seen as the most important operation. Uses Australian bagging machines.
- He also de-leaves the whole farm 1.5 times a week because black Sigatoka moves so fast .The de-leafers also prune the top hand off with their hook knives as soon as possible and count the new bunches
- Never puts bunch on the ground. He has a trailer for hanging bunches for transport to the shed.
- Doesn't remove flowers in shed. Does it while bunch is growing.
- Uses silky thin plastic bunch cover. It doesn't cause rub marks.
- A small press was used here (and in most sheds) for compacting used bunch covers. Everywhere we went, in all three countries, one-use bunch covers were prevalent.
- Interesting technique for nurse suckering plant trees: Initially a single row is planted, then heart of plant tree is gouged out, leaving a sucker each side plus one in the middle. Will then have 3 bunches at the right time; then next ratoon the middle tree will be killed and the farm goes back to double sucker.
- Mr Aubrey had an effective trailer that transported bunches to the shed without bruising. No pads were used between bunches and no fruit bruising was evident because the bunches just hung there firm with nothing touching them.

Nurse suckering, Aubury Farm

Trailer at Aubreys Farm

Frederick De Reynal's Farm

- An innovative, large farmer. He has developed or applied lots of inventions, e.g. mechanisation to save labour, which suits his farm which is hilly, high altitude (400m)
- Developed herbicide applicator on quad bike that sprays 6 metres and a fungicide applicator on quad bike.
- Uses Success 4 to protect bunch. No other insecticides are used.
- No irrigation, 4.5 m rain/ year.
- Uses pheromone borer traps.
- He counted waste at 23% i.e. 10% stalk and 13 % banana fruit.
- Automatic carton supply system is utilised as with a single carton lifter and placement on pallet
- Plants the tissue cultured bananas to the level of pot plant, and noted the plant will be pushed up by following suckers if planted deeper.
- He had a different type of trailer for hanging bunches for transport to the shed. They had pads between the bunches.

Banana Varieties

- GALL is most popular variety, from Arhan Laboratory in Israel. It is robust and good yielding
- Growers on the study tour differed in their views on the variety. Some were adamant that it needed trialling in Australia urgently. However, one grower noted that GALL may not be suitable in Australia because the growing conditions in Martinique are very good and consistent year round. Williams was considered to be better able to handle extremes better. Another grower noted that while GALL has been in Martinique for

10 years, trials have just started with it in Ecuador. Mr Aubrey noted that it was not a good variety in the colder areas, and very few were evident on the De Reynal Farm at 400m above sea level [4]

- Growers pay 2.17 Euro per 30cm plant.

Banamart

- Banamart is the banana growers' association of Martinique.
- It employs 45 people growers pay a compulsory levy per tonne.
- It provides:
    - Technical support, purchasing & logistics and finance
    - Organisation , management & collection of waste- plastic & string
    - Creation of training for farm staff
    - Quality control & management of stuffing
    - Supply of inputs for production
    - Management of certifications
    - Distribution of funds to growers
    - Together with an equivalent Guadeloupe organisation, Banamart forms Banane a company for exporting and other commercial activities.

4. Since returning from the Study Tour, Steve Lavis has commenced the procedure to import the GALL variety. He also noted that recent progress was made by QDAFF on this as well.

4. Results of discussions, implications for Australian bananas and recommendations - 2014 study tour

1. More emphasis on bunch protection

It was widely evident at all farms in all three countries that great care is taken to ensure the bunch reaches the packing facility in a pristine condition. In Ecuador and Costa Rica, the system used in the field was a cableway to transport bunches to the shed. Martinique farmers use sophisticated tractor drawn trailers which allowed bunches to hang freely without touching each other on way to shed.

It is not clear how such systems may be successfully implemented in Australia but more thought is required in this area .

The use of pads and jigs to avoid pressure injuries to the bunches, while they are being humped is something that could also have benefits to the harvesting process used in Australia. The evidence was clear that packing facility operation is much improved when fruit is arriving at shed clear of damage. The additional care in the plantation may pay off for some via better quality and less waste in the packing shed.

2. More Consideration of Chemicals

All farms that exported to Europe had stringent conditions placed on them with regards to what chemicals they can use. No farm we visited used any insecticides on their soil. Nematicide use was either low or non-existent. In Australia, like Martinique, great advances have been made in reducing the use of nematicides.

However, Australia has not been as advanced in non-chemical management of Banana Weevil Borer. The use of pheromone lures would help reduce insecticides used, but as shown in Martinique, the issue is labour cost. In an average farm infestation 2 traps per acre were required. It is labour intensive to insert traps and to count and kill borers.

The only chemical treatments were for black and yellow Sigatoka, post-harvest crown fungus control and impregnated bunch covers or strips. All farmers and agronomists indicated that root and soil health were the key to being able to farm successfully without traditional chemicals.

It would require a great leap of faith to farm like this in Australia, without research to prove economic viability. The countries we visited have been forced down the path they are on because of retailer or European Union requirements. In this case the economic impact was the same for all farmers. The Australian industry could consider this matter now, before similar requirements, e.g. banning of certain insecticides and/or aerial spraying are required here.

Environmentally sustainable farm practices are used in Australia. However, major Australian retailers may in future have a different view of what "sustainable" means, even if just for differentiation from competing retailers. Senior management of these retailers tend to have European retail backgrounds.

3. Sap Management

Sap (latex) build up on packing shed equipment seemed well in control at all packing facilities visited. Some facilities used additives to sorting tanks but it was not at always clear what the additives were. One facility used intravenous drip technology to give controlled release of additive to water. At least one facility in Costa Rica was using citric acid in their water tanks. Another facility in Ecuador was using Biolatex (an anionic surfactant) to break down sap. A comprehensive review of what is available around the world would be useful, so that products can be trialled in Australian facilities.

4. Varieties

Only a small percentage of varieties grown in the countries visited were Williams or Grande Naine. Of the varieties used, the Israeli variety 'GALL' showed the most promise of being suited to Australian conditions. Consideration should be given to studying this variety for Australian conditions as soon as possible. This is an existing successful commercial variety and should be easy to trial in Australia in much the same way as Grande Naine was in the eighties.

5. Are our Cartons too Complex?

The cartons used for export from all three countries were of simpler construction and cheaper than those used in Australia. Farm to port roads were of equivalent or worse condition than those in Australia, putting fruit through ample shock and vibration testing. The footprint of these cartons is different to those used in Australia due to International pallet sizes. That is, the 18 Kg boxes could not be stacked on Australian pallets as there would be too much wasted space on the pallet, which is wider than the International pallet.

While there are many variables in carton design and carton design is only one factor in providing quality banana at the consumer end, from purely qualitative observation, it would appear that Australian cartons tend to be unnecessarily complex and expensive.

There may also be differences with cartons designed to reduce damage to fruit in long haul road transport (in Australia) versus cartons used in Central America where shipping, rather than road haulage is more a factor.

6. Collaboration with Earth University

There is a potential benefit to the Australian industry (and other industries) if Australia was to either fund a position for an Australian Agriculture Science student to attend Earth University, or for an Australian company or research organisation to provide 15 weeks employment for a fourth year Earth University student. Either or both of these opportunities may help to get scientific information flowing from Costa Rica to Australia, and visa versa.

5. Dissemination of Information - 2014 study tour

Jim Pekin presented findings of the study tour to the Mareeba Banana Growers' Association meeting on the 8th October. Jim Pekin, Paul Johnson and Stephen Lowe presented at the Cassowary Coast Banana Growers' Association on the 9th October. Jim Pekin and Peter Molenaar will be presenting at the Tweed Brunswick banana growers association meeting on the 12th November.
An article is in preparation for the upcoming 'Australian Bananas' magazine. Other meetings and publications will also be used to disseminate information.

6. Acknowledgements - 2014 study tour

- Jose Maria Guerrero (Tucho): Fyffes, Ecuador
- Eduardo Garcia, Executive Director, Ecuadorian Banana Exporters Association
- Alisdair Macleod, Managing Director, Fyffes Bananas International,
- Genivaldo Pereira: Fyffes, Costa Rica
- Dr Luis Pocasangre, and Ms Fabiola María Ramírez Arrieta of Earth University, Costa Rica
- Anne-Laure Marie, Muma Fruits and Ban Hackaert, Martinique
- Karine Vincent and Caroline Marion of Banamart; Martinique
- Sébastien Bonduelle and Gwenaelle Cottin of SCIC Environmental ; Martinique
- Marc Jackson: Fyffes, Asia and Oceania
- All the growers who showed us their farms
- Dr Jay Anderson & Alix Perry, ABGC for their organisational assistance and advice
- HAL – for its part funding

7. Participant List - 2014 study tour

Name	Background	Location
Adrian Crema	Banana Grower,	Tully, Queensland
Andrew Coulson	Banana Grower,	Mareeba, Queensland
Craig Buchanan	Banana Grower,	Innisfail, Queensland
Dino Costa	Banana Grower,	Tully, Queensland
Paul Drury	Banana Grower,	Tully, Queensland
Marc Jackson	Tour leader,	Cairns, Queensland
Paul Johnston	Banana Grower,	Tully, Queensland
Peter Molenaar	Banana Grower,	Mullumbimby, New South Wales
Stephen Lowe	Banana Grower,	Tully, Queensland
Stephen Lavis	Nurseryman,	Mission Beach, Queensland
Christopher Jamieson	Banana Grower,	Lakeland, Queensland
Gavin Mackay	Banana Grower,	Tully, Queensland
Jim Pekin	Tour Organiser & CEO, ABGC	Brisbane, Queensland

Study tour participants with Dr Luis Pocasangre of Earth University.

Appendices

Appendix 1

Quarantine measures for study tour participants. Similar advice was prepared for the Central America tour as well.

Banana Study Tour – Quarantine measures

In order to prevent the movement of pests and diseases from country to country, there are some steps all growers must follow:

1. Take old shoes or buy some cheap ones which you are able to dispose of between China and the Philippines, and the Philippines and Australia.
2. Before departing Australia please ensure that the shoes you intend to wear on farms are clean. A good scrub with soap and water is what is required. Removing the dirt will take any fungi and bacteria away too.
3. When we leave China please dispose of the shoes you wore on the Chinese farms.
4. When we leave the Philippines please dispose of the shoes you wore on the Filipino farms.
5. Ensure clothes are laundered so that soil on the cuffs of long pants, and any fungi or bacteria are removed. There is a laundry service where we are staying at the Park Inn Hotel in Davao and I am sure that there will be a similar service available in Sanya.
6. When on farms be careful to not put any thing you are carrying (such as backpacks, hats etc.) down in soil or plant material – this may be a pathway for pests and diseases.
7. Be careful to not transfer soil or plant material from shoes or clothing onto your clean luggage. Use plastic bags to separate your dirty cloths from clean and dispose of those bags when clothes are sent for laundering.
8. Under no circumstances move plant material from one country to another.

By following these steps and thinking carefully about possible pest and disease pathways we will prevent the movement of pests and diseases between countries and show respect to our hosts in each country.
All of these measures are extremely important, if you have any questions please contact me as soon as possible.

Tour highlights threats, opportunities

An inside look at banana production in China and the Philippines has provided new ideas now being put into action by participants in an industry study tour. ABGC R&D Manager Jay Anderson reports.

A study tour to China and the Philippines has given members of Australia's banana industry insights into major biosecurity issues as well as different approaches to fertiliser development, fruit handling and transport.

The 10-day September tour gave the group of growers and nurserymen a first-hand look at major biosecurity issues for global banana production. They saw the effects of Panama Disease Tropical Race 4 (TR4), Moko disease and black Sigatoka and the extra efforts required to manage these diseases.

Seeing a plantation in Hainan Island which has been abandoned due to TR4 had a big effect on tour participants. They have returned with a resolve to work on their own on-farm biosecurity but have also requested ongoing commitment by all involved in the banana industry – growers, industry leadership, ABGC, industry partners, researchers and State and Federal governments.

In China, study tour participants were fascinated with the development of various organic fertilisers and the high-tech fertigation delivery systems. Organic fertiliser made from the by-products of tapioca and ethanol manufacture mixed with mill ash is made by the Jin Sui Agricultural company and used by the many smaller growers who grow for the company.

The attention to quality in the Philippines was impressive. Quality control was high in the manufacture of cartons and plastics for use in the industry. Fruit was handled with care from the early stages when plastic sheets were used between hands to prevent rub, right through to the refrigerated storage used for fruit prior to loading at the wharves.

The visit to Asia Fruit Logistica in Hong Kong demonstrated to the group that other Australian horticultural commodities have achieved a high level of representation on the world stage. Study tour participants saw the latest innovations in transport, handling and marketing fruit and vegetables. The visit generated discussion amongst tour participants – in Australia we are in a prime position to supply produce to all of Asia but we cannot compete with other countries where there are significantly lower cost of production; we need to differentiate ourselves based on quality or look for savings through mechanisation.

Members of the study tour present some Australian Bananas merchandise to their hosts in China.

Tour diary

- Sept 4th & 5th: Hong Kong, China – visited Asia Fruit Logistica Expo
- 6th: Nanning, Guangxi Province, China – visits to farms, a market place and fertiliser plant
- 7th: Nanning, China – farm visits
- 8th & 9th: Sanya, Hainan Island, China – visits to farm, trial site and tissue culture laboratory
- 10th to 12th: Travel to Davao, the Philippines – visits to box factory, plastics factory and nursery. Farm and packing shed visits, wharf visit to see export fruit loaded onto ships.
- 13th – return to Australia

Our thanks

The study tour was a valuable experience not only for the participants but for others in the industry who will share in the knowledge gained.

The tour group acknowledges the work of Marc Jackson in organising a fantastic itinerary. Simon Zhang is thanked for an excellent tour of the Chinese banana growing areas. John Perine, Unifruitti is thanked for the excellent Philippines itinerary and the group is also most appreciative of the time taken by Rey Valle, Unifruitti, to host the group.

Above: See that? Study tour members see how bagging is done in China. Below right middle: Bunches taken to market in China. Below right bottom: Grower Andrew Serra assists with in-field banana packing in China.

Highlights

- Demonstrated to Australian growers that we can't take our good disease status for granted
- Seeing the use of organic fertilisers and automated fertigation systems in China
- A whole-of-chain look at banana growing in the Philippines, from growing to transport to the wharf for export, and the focus on quality.

What happened on tour hasn't stayed on tour

Participants have been speaking with other growers about the trip. Here's a snapshot of some of the thoughts and ideas from study tour members:

Paul Inderbitzin, grower, Lakeland

"Since the trip through China I have gained a great appreciation for quarantine. Inductions now include a few basic rules framed around quarantine and biosecurity to highlight its importance to the new team members.

"When we recruit new staff we ask where they have been and if necessary supply new footwear. Foot baths and vehicle wash bays are being considered in our business plan to be implemented in critical control points."

Craig Althaus, nurseryman, Tully

"I'm planning upgraded quarantine measures at the nursery, including restricted access to production areas, vehicle and foot-sterilising baths and signage.

"Other measures include resurfacing the nursery surrounds, changing two greenhouse floor surfaces and trialing certified potting mixes from southern suppliers to eliminate the need to have potting mix stored in bays and exposed to contamination.

"The racks we use to transport plants to other farms have been stripped and repainted to allow improved sterilisation prior to them being reused. The tour also reinforced the importance and the effectiveness of the existing QBAN (Quality Banana Approved Nursery) system and I am now better able to promote the scheme with the growers I supply."

Darryl Apap, grower, Mission Beach

"Fertiliser is the big thing we are looking at. We are setting up tanks in the irrigation shed so it can auto feed with the water irrigation pump."

Stephen MacKay, grower, Tully

"The study tour reinforced my thoughts on why the industry needs a stronghold on all quarantine issues, especially the fact of our island status. We should also be very aware of not introducing anything accidentally and it is just important that your own farm quarantine is part of the solution of not getting these incursions."

Weiwei Cui, shed supervisor, Mareeba

"It's important to keep diseases out of our bananas. All necessary quarantine measures need to be put into action."

Andrew Serra, grower, Tolga

"We have now put a section in our induction that asks workers if they have worked on farms in the Northern Territory or on

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